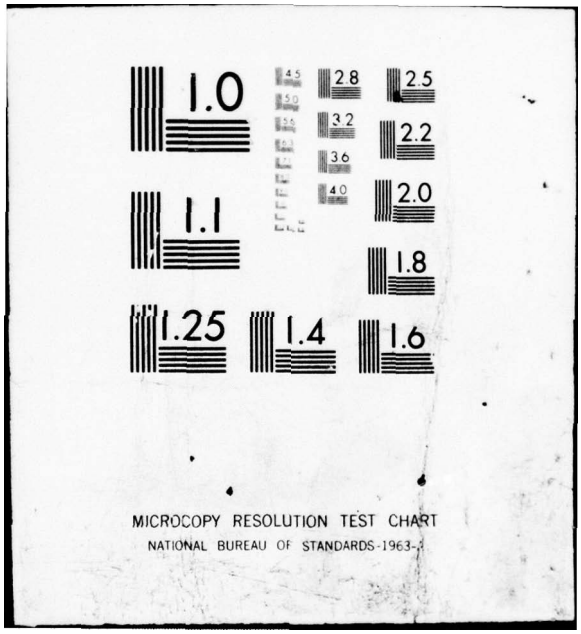
AD-A071 789 NAVAL OCEAN SYSTEMS CENTER SAN DIEGO CA F/G 17/2.1
TACTICAL INTELLIGENCE LINK CONTROL FACILITY (TLCF) SUBSYSTEM RF--ETC(U)
MAR 79 D P HURST

UNCLASSIFIED NOSC/TD-216 NL

1 OF 1
AD
A071789

END
DATE
FILMED
8-79
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

LEVEL

NOSC

NOSC TD 216

NOSC TD 216

Technical Document 216

TACTICAL INTELLIGENCE LINK CONTROL FACILITY (TLCF) SUBSYSTEM RF LINK REMOTING DESIGN AND INSTALLATION PLANS

DP Hurst

March 1979

Prepared for
Naval Electronic Systems Command (PME 106)

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

NAVAL OCEAN SYSTEMS CENTER
SAN DIEGO, CALIFORNIA 92152

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CA 92152

AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

RR GAVAZZI, CAPT USN
Commander

HL BLOOD
Technical Director

ADMINISTRATIVE INFORMATION

The work described in this Technical Document was performed for the Naval Electronic Systems Command (PME 106) by members of the Integration Branch under element 64562N/X0959, project OS/X0959, task OS/733, work unit SX13.

Released by
LCDR DO White, Head
Multisource Integration Division

Under authority of
RE Shutters, Head
Surface/Aerospace Surveillance Department

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: NOSC Technical Document 216 (TD-216)
2. GOVT ACCESSION NO.:
3. RECIPIENT'S CATALOG NUMBER: Technical Document

4. TITLE (and Subtitle): TACTICAL INTELLIGENCE LINK CONTROL FACILITY (TLCF) SUBSYSTEM RF LINK REMOTING DESIGN AND INSTALLATION PLANS
5. TYPE OF REPORT & PERIOD COVERED: Design and Installation Plans
6. PERFORMING ORG. REPORT NUMBER:

7. AUTHOR(s): D.P. Hurst
8. CONTRACT OR GRANT NUMBER(s):

9. PERFORMING ORGANIZATION NAME AND ADDRESS: Naval Ocean Systems Center, San Diego, CA 92152
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 64562N/X0959, OS/X0959, OS/733, SX13

11. CONTROLLING OFFICE NAME AND ADDRESS: Naval Electronic Systems Command (PME 106), Washington, DC 20360
12. REPORT DATE: March 1979
13. NUMBER OF PAGES: 32

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): 47 p.
15. SECURITY CLASS. (of this report): Unclassified
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Tactical Intelligence Link Control Facility (TLCF)
Fleet Satellite Communication System (FLTSATCOM)
Tactical Intelligence System (TACINTEL)
Rf links
Remoting

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

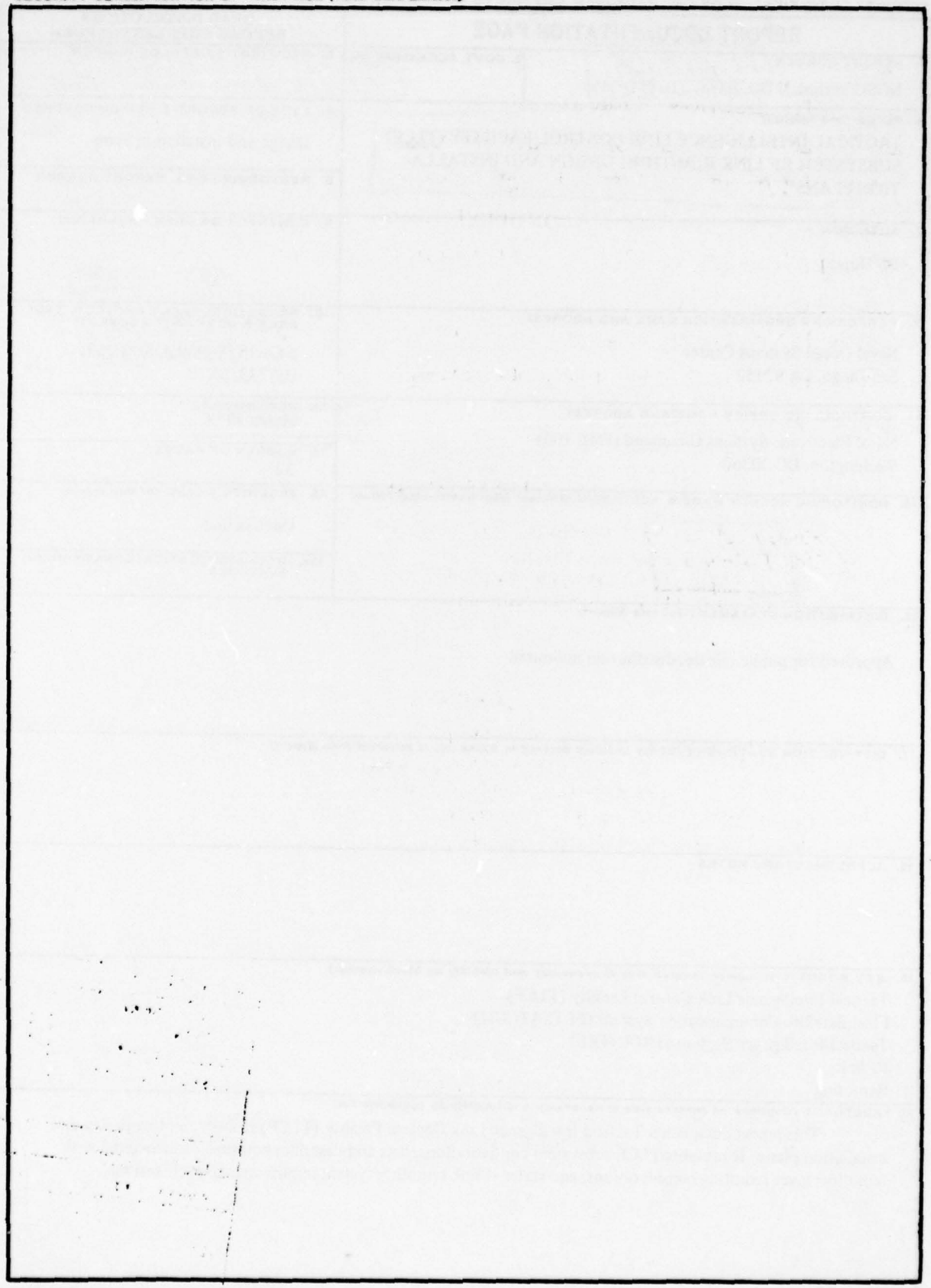
This report documents Tactical Intelligence Link Control Facility (TLCF) rf link remoting design and installation plans. It presents TLCF subsystem configurations, lists and describes equipments associated with remoting, gives remoting considerations, and states rf link remoting system requirements/specifications.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601 |

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

893159



CONTENTS

1.0 INTRODUCTION . . . page 3

2.0 TLCF SUBSYSTEM CONFIGURATIONS . . . 3

3.0 REMOTED TLCF SUBSYSTEM EQUIPMENTS . . . 5

4.0 TLCF rf LINK REMOTING CONSIDERATIONS . . . 18

5.0 REMOTING LINE ROUTING AND PATCHING PHILOSOPHY . . . 18

6.0 RECOMMENDATIONS . . . 19

APPENDIX A: TLCF EQUIPMENT CONNECTOR-PIN ASSIGNMENTS . . . 21

APPENDIX B: TLCF SYSTEM LINE DEFINITIONS . . . 28

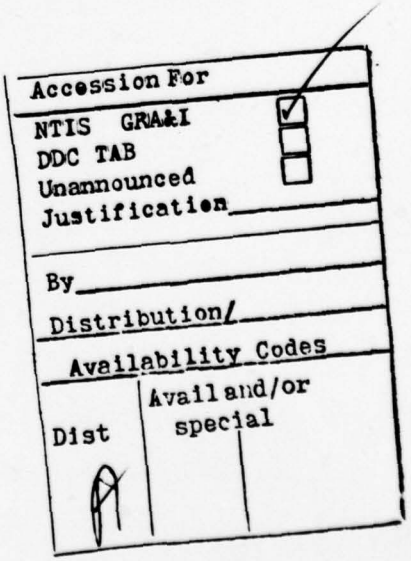
BIBLIOGRAPHY . . . 31

ILLUSTRATIONS

1. Single TLCF subsystem configuration . . . page 4
2. Dual TLCF subsystem configuration . . . 6
3. Detailed single TLCF subsystem wiring diagram . . . 9
4. Detailed dual TLCF subsystem wiring diagram . . . 11

TABLES

1. List of equipments associated with TLCF rf link remoting . . . page 5
2. Single TLCF subsystem lines that require remoting . . . 15
3. Single TLCF remoting line types and specifications . . . 15
4. Dual TLCF subsystem lines requiring remoting . . . 16
5. Dual TLCF remoting line types and specifications . . . 16



1.0 INTRODUCTION

1.1 This report documents the NOSC Tactical Intelligence Link Control Facility (TLCF)* radio frequency (rf) link remoting and installations design effort. It also promulgates adequate information to write the TLCF rf link remoting Standard Plans. It presents the two possible TLCF subsystem equipment configurations, and also lists and defines the equipment and lines associated with rf link remoting. Detailed remoting line requirements are also given for the two configurations. The rf link remoting discussed in this report is designed to support 2400-bps operation only. Further considerations must be given to the line modems if higher data rates are desired.

1.2 Since this report is unclassified, information pertaining to TLCF coverage areas, the installation sites, the TLCF subsystem backup philosophy, and remoting distances has been left out.

2.0 TLCF SUBSYSTEM CONFIGURATIONS

2.1 The "single TLCF subsystem configuration" is the first equipment configuration to be considered. In this type of installation, the subsystem is responsible for only one subscriber net in one satellite coverage area. The single TLCF subsystem communicates with its subscribers on only one satellite channel. The equipment configuration design is such that two complete suites of equipment exist. The first is used for the TLCF subsystem, while the second can be used for equipment replacement, for troubleshooting downed equipment, or as a subscriber. This allows for a high system availability and a low mean time to repair (MTTR) and provides added system confidence. Figure 1 represents a general block diagram of the single TLCF subsystem configuration.

2.2 An overview of the single TLCF subsystem configuration also is given in figure 1. The ON-143 interconnecting groups (IGs) have data and control lines which interface through the Link Test/Status Unit to landline modems. The Voice Frequency Carrier Terminal, VFCT, transmits/receives the low-speed status and control signals to/from the VFCT in the remote uhf radio area. The data line modems transmit/receive the high-speed data signals to/from the data line modems at the remote uhf radio area. The equipment in the uhf radio area transmits/receives information to/from the TLCF subscribers. The data, control, and status lines associated with this information are remoted to the TLCF subsystem area by landline modems.

2.3 The "dual TLCF subsystem configuration" is the second equipment configuration considered. In this case, there are two TLCF subsystems. Each is responsible for a subscriber net in different satellite coverage areas. The second TLCF subsystem is to serve as an alternate TLCF subsystem. The equipment configuration design consists of three suites of equipment, as contrasted with the two in the "single" TLCF subsystem. The TLCF equipment of suite A (TLCF subsystem A) is used for primary coverage area one on satellite

*Formerly NELC TLCF design effort.

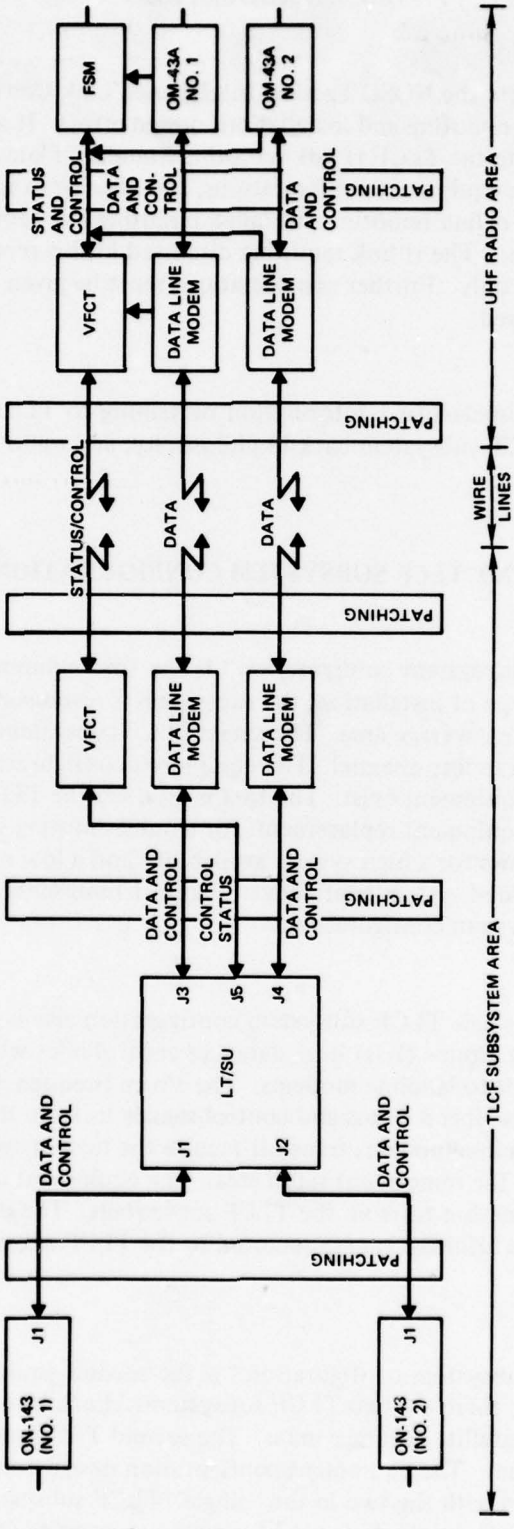


Figure 1. Single TLCF subsystem configuration.

one. Suite C TLCF equipment (TLCF subsystem C) is used for coverage area two on satellite two should it be required. Suite B TLCF equipment (TLCF subsystem B) may serve as a TACINTEL subscriber to TLCF subsystem A or C, for equipment replacement, or for trouble-shooting TLCF subsystem A or C. This maintains high system availability and keeps the MTTR low. Figure 2 represents a general block diagram of the dual TLCF subsystem configuration.

3.0 REMOTED TLCF SUBSYSTEM EQUIPMENTS

3.1 The equipments listed in table 1 are required to implement a remoted TLCF subsystem. The following paragraphs define and discuss each piece of equipment listed in table 1.

Table 1. List of equipments associated with TLCF rf link remoting.

Item	Name	Designation	Quantity Required per System	
			Single TLCF	Dual TLCF
1	Data processing set	AN/UYK-20X(V)	2	3
2	Interconnecting group	ON-143(V)/USQ	2	3
3	Link test/status unit (LT/SU)	(Note 1)	2	3
4	Data line modem	(Note 2)	4	6
5	Voice frequency carrier terminal (VFCT)	(Note 3)	6 send channels, 11 receive channels (note 3)	4 send channels, 7 receive channels (note 3)
6	Fleet satellite communications spectrum monitor system (FSM)	--	1	1 or 2
7	Uhf radio subsystem:			
	Interface group	--	1	2
	Modem group	OM-43A/USC	2	4
	Radio set group	AN/WSC-5(V)	1	2
	Antenna group	--	1	2

Notes:

1. The official LT/SU nomenclature and designation are applied for.
2. Many commercial data line modems are available that will meet the 2400-bps requirements; eg, ICC* 2200/24 or Bell System WE201B.
3. Different types of VFCT are available. Indicated send and receive channels are in reference to the TLCF subsystem area.

*International Communications Corp.

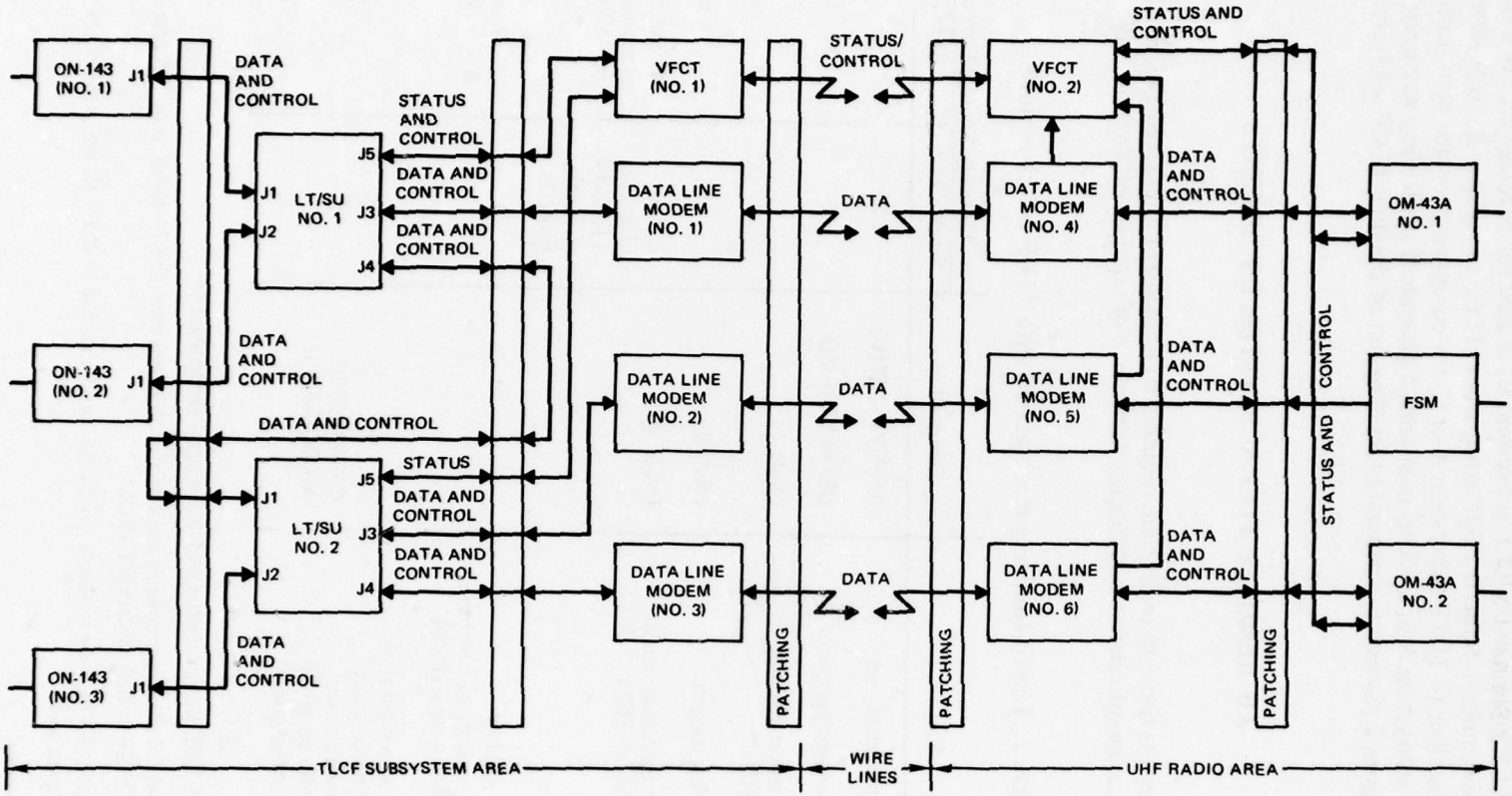


Figure 2. Dual TLCF subsystem configuration.

3.2 Data Processing Set AN/UYK-20X(V)

3.2.1 The Data Processing Set AN/UYK-20X(V) (referred to as the DPS) is the central processing unit (CPU) of the TLCF subsystem. It is a general-purpose militarized digital data processor with maximum core memory of $65\,535_{10}$ sixteen-bit words. The DPS is under microprogram control and uses a pipelining architecture. The reader may obtain and study NAVELEX Document 0967-LP-598-1030 for detailed information on AN/UYK-20X(V) operation.

3.2.2 The AN/UYK-20 DPS controls TLCF communications with its subscriber net. The DPS also interfaces to the other subsystems which supply/use the tactical intelligence processed by the TLCF subsystem. CPU peripherals are interfaced to the DPS to implement the TLCF capabilities.

3.2.3 Appendix A lists DPS rf link connector pin assignments.

3.3 Interconnecting Group ON-143

3.3.1 The TLCF subsystem ON-143 interconnecting group (IG) contains circuitry to interface the AN/UYK-20 digital processing set (DPS), KG-36/KG-34 crypto, and the uhf radio. The ON-143 IG has capabilities (eg, vocoder, TTY level converters) not utilized by the TLCF subsystem. The only functions used by the TLCF subsystem are transmit sequencing and receive synchronization.

3.3.2 Upon command by the DPS to transmit, the ON-143 IG transmit sequencing circuitry will turn on the uhf OM-43A modem by raising DATA KEYLINE. A short time later it will PREP the KG-36, count a required number of CRYPTO GATED CLOCK periods, and apply DPS TRANSMIT CLOCK to the AN/UYK-20 DPS. NAVELEX Document 0967LP614710 explains the ON-143 IG transmit sequencing circuit operation in detail.[1]

3.3.3 A message indicate start synchronization sequence being received by the KG-36 crypto initiates the receive cycle. Upon crypto generation of GATED CLOCK, the ON-143 IG receive synchronization circuitry counts four clock periods and forwards inverted GATED CLOCK to the AN/UYK-20 as DPS RECEIVE CLOCK.

---

1. Naval Electronic Systems Command, Technical Manual, Operation Instructions/Maintenance Instructions, Intelligence Interconnecting Group ON-143(V)/UFQ, NAVELEX Document 0967LP614710.

3.3.4 The ON-143 IG transmit sequencing and receive synchronization circuits are both red. The DPS and one-half the crypto are red, while the uhf radio, modems, one half of the ON-143 IG, and the other half of the crypto are black. The ON-143 IG uses optical isolators and relays to separate the red and black portions of its circuitry, along with physical separation.

3.3.5 Appendix A lists ON-143 rf link connector-pin assignments.

3.4 Link Test/Status Unit

3.4.1 The link test status unit will be referred to as the LT/SU. The LT/SU is designed and utilized in the TLCF subsystem for the following purposes:

A. Equipment configuration
   1. Subscriber selection
   2. NORMAL mode of operation
   3. MONITOR mode of operation
   4. BACK-TO-BACK mode of operation
   5. Test mode of operation
   6. Loop back at uhf radio

B. Remoting and uhf radio status

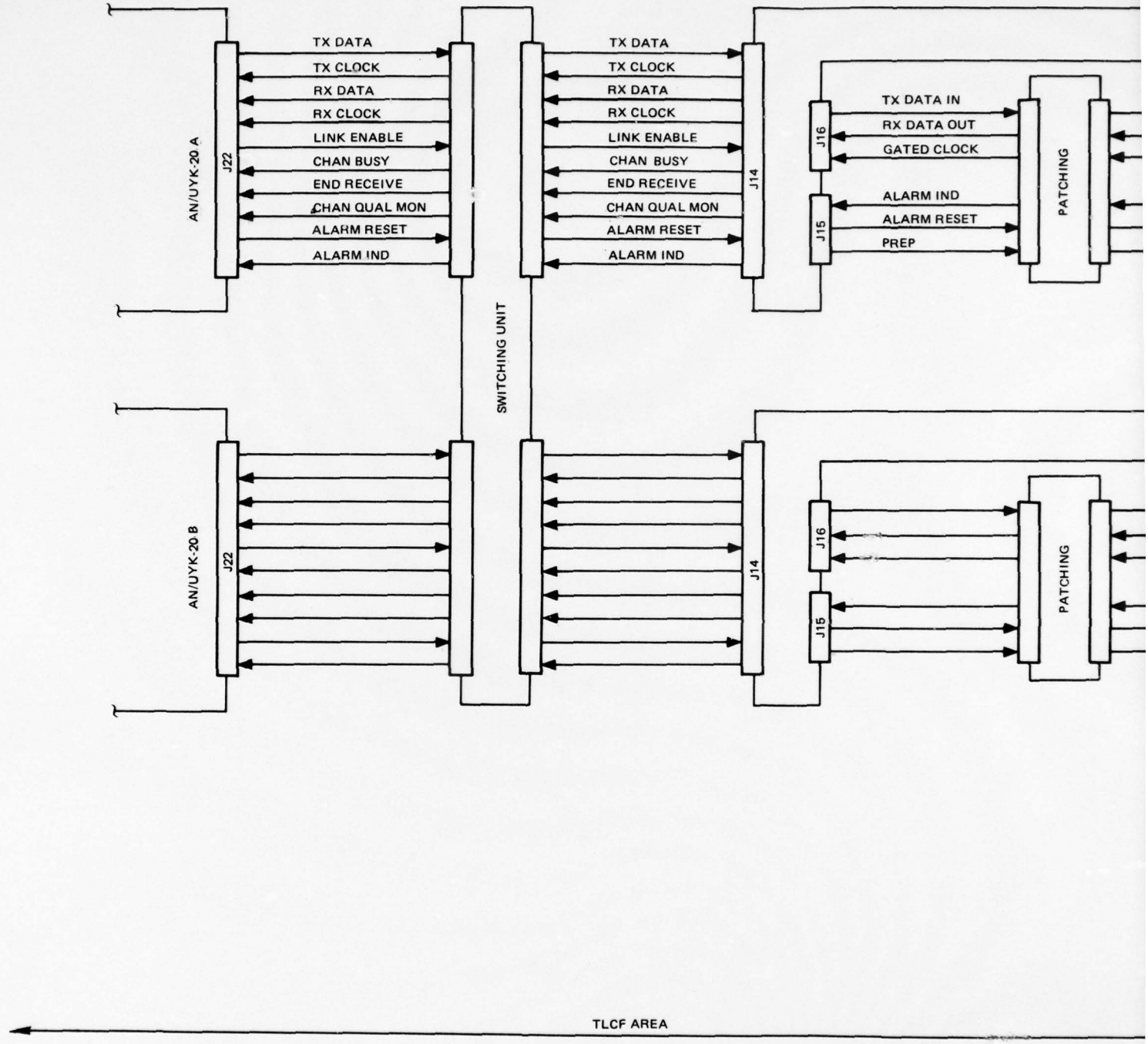
C. System troubleshooting

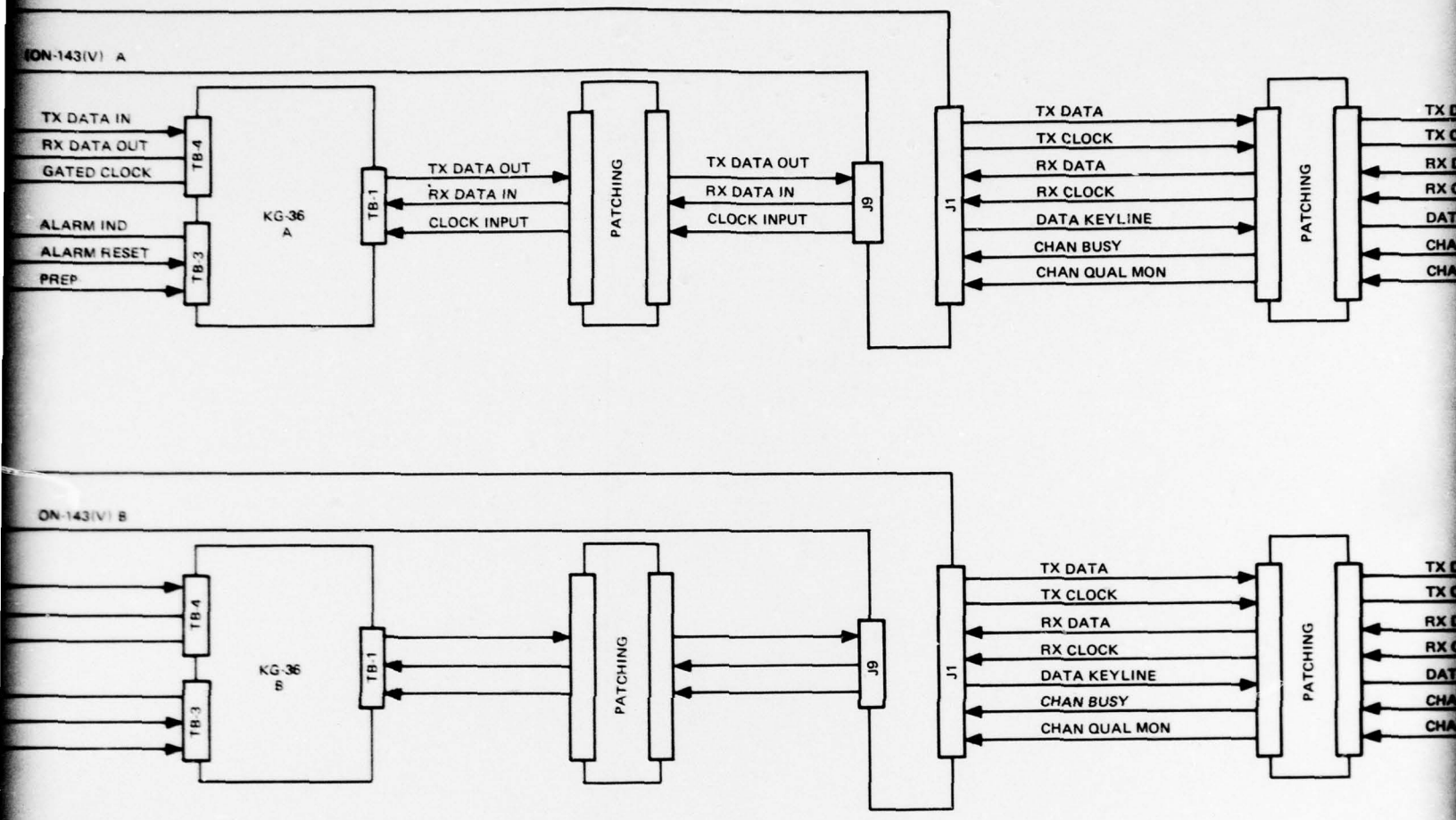
D. Provide operator system confidence.

3.4.2 The LT/SU selects the ON-143 interconnecting group (referred to as the ON-143 IG), which will serve as the simulated subscriber subsystem in the TLCF equipment area. The SUBSCRIBER toggle switch, which selects the subscriber ON-143 IG, also has a center position which allows both ON-143 IGs to serve as TLCFs rather than restrict one to a subscriber.

3.4.3 The LT/SU has four modes of operation. The following subparagraphs define each mode of operation. Figures 3 and 4 should be referred to for each description.

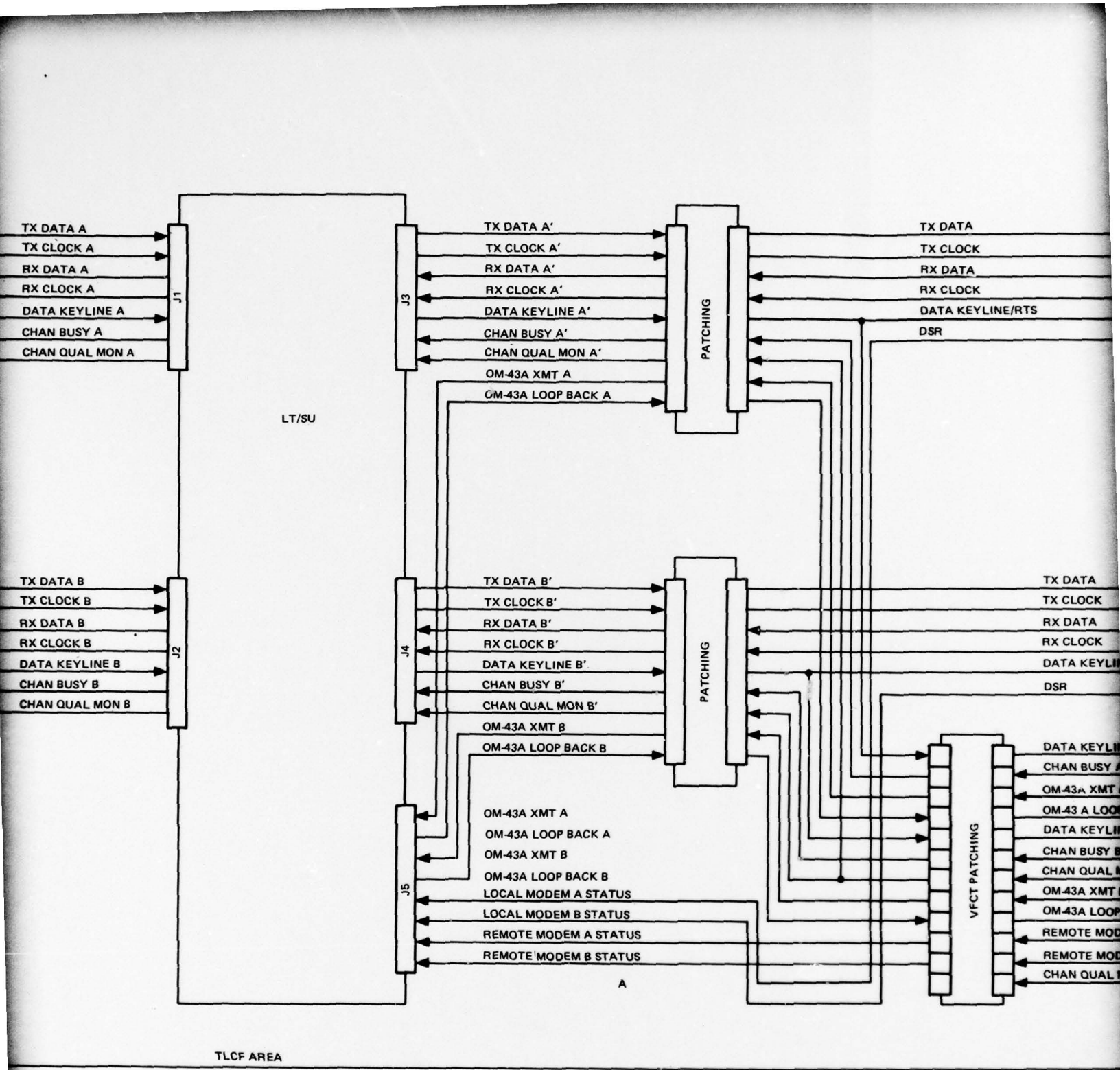
3.4.3.1 The LT/SU NORMAL mode of operation configures the TLCF subsystem area such that LT/SU port J1 is normal through to port J3, and port J2 is normal through to port J4. In this mode of operation, the ON-143 IG connected to LT/SU J1 communicates with the line modem connected to LT/SU J3; likewise, the ON-143 IG connected to LT/SU communicates with the line modem connected to LT/SU J4.

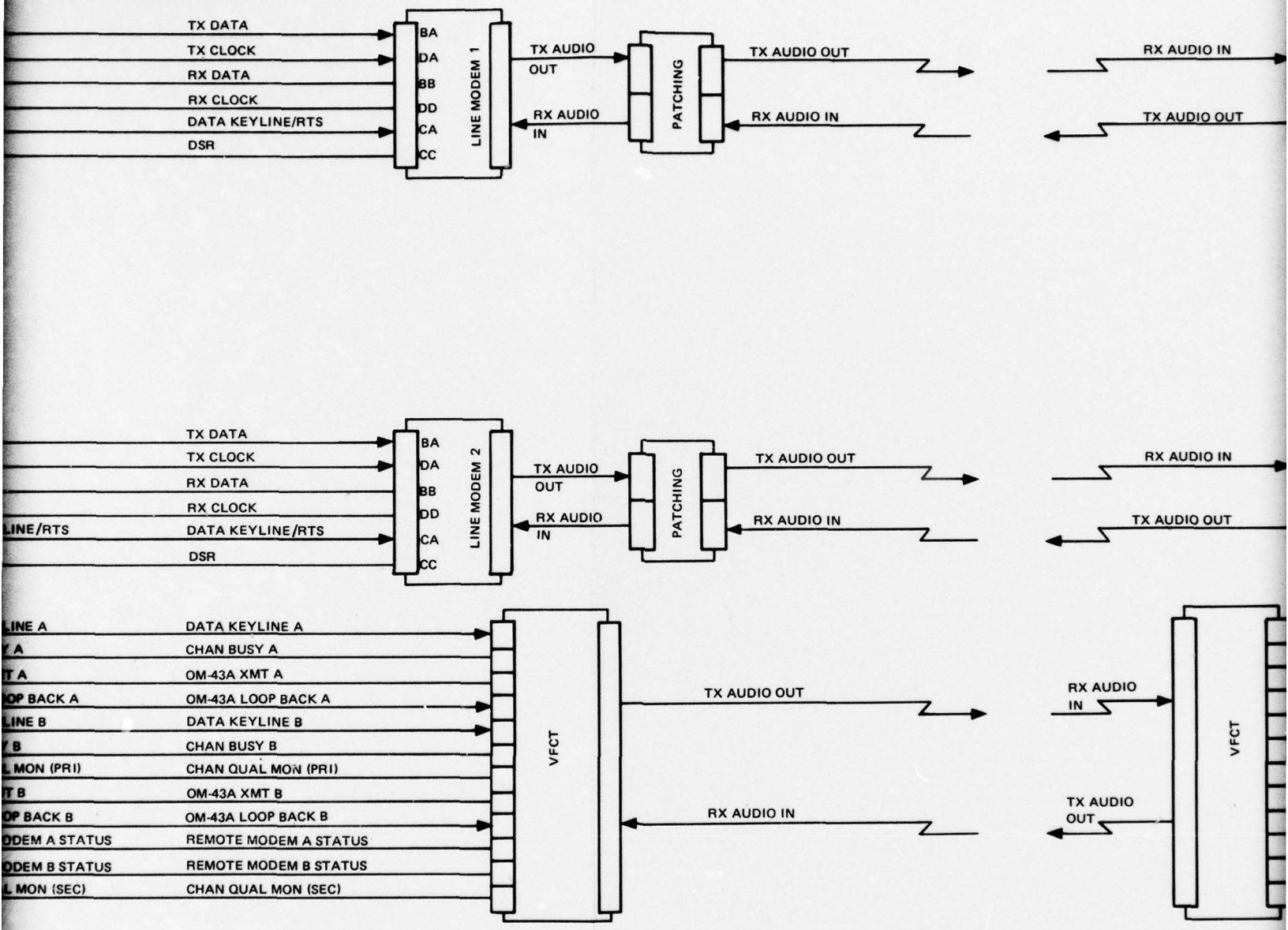

AN/UYK-20 A
J22
TX DATA
TX CLOCK
RX DATA
RX CLOCK
LINK ENABLE
CHAN BUSY
END RECEIVE
CHAN QUAL MON
ALARM RESET
ALARM IND
SWITCHING UNIT
TX DATA
TX CLOCK
RX DATA
RX CLOCK
LINK ENABLE
CHAN BUSY
END RECEIVE
CHAN QUAL MON
ALARM RESET
ALARM IND
J14
J16
TX DATA IN
RX DATA OUT
GATED CLOCK
J15
ALARM IND
ALARM RESET
PREP
PATCHING
AN/UYK-20 B
J22
J14
J16
J15
PATCHING
TLCF AREA


ON-143(V) A
TX DATA IN
RX DATA OUT
GATED CLOCK
TB-4
ALARM IND
ALARM RESET
PREP
TB-3
KG-36
A
TB-1
TX DATA OUT
RX DATA IN
CLOCK INPUT
PATCHING
TX DATA OUT
RX DATA IN
CLOCK INPUT
J9
J1
TX DATA
TX CLOCK
RX DATA
RX CLOCK
DATA KEYLINE
CHAN BUSY
CHAN QUAL MON
PATCHING

ON-143(V) B
TB-4
TB-3
KG-36
B
TB-1
PATCHING
J9
J1
TX DATA
TX CLOCK
RX DATA
RX CLOCK
DATA KEYLINE
CHAN BUSY
CHAN QUAL MON
PATCHING

TLCF AREA


TX DATA A
TX CLOCK A
RX DATA A
RX CLOCK A
DATA KEYLINE A
CHAN BUSY A
CHAN QUAL MON A
J1
LT/SU
J3
TX DATA A'
TX CLOCK A'
RX DATA A'
RX CLOCK A'
DATA KEYLINE A'
CHAN BUSY A'
CHAN QUAL MON A'
OM-43A XMT A
OM-43A LOOP BACK A
PATCHING
TX DATA
TX CLOCK
RX DATA
RX CLOCK
DATA KEYLINE/RTS
DSR
TX DATA B
TX CLOCK B
RX DATA B
RX CLOCK B
DATA KEYLINE B
CHAN BUSY B
CHAN QUAL MON B
J2
J4
TX DATA B'
TX CLOCK B'
RX DATA B'
RX CLOCK B'
DATA KEYLINE B'
CHAN BUSY B'
CHAN QUAL MON B'
OM-43A XMT B
OM-43A LOOP BACK B
PATCHING
TX DATA
TX CLOCK
RX DATA
RX CLOCK
DSR
J5
OM-43A XMT A
OM-43A LOOP BACK A
OM-43A XMT B
OM-43A LOOP BACK B
LOCAL MODEM A STATUS
LOCAL MODEM B STATUS
REMOTE MODEM A STATUS
REMOTE MODEM B STATUS
A
VFCT PATCHING
TLCF AREA


TX DATA
TX CLOCK
RX DATA
RX CLOCK
DATA KEYLINE/RTS
DSR
BA
DA
BB
DD
CA
CC
LINE MODEM 1
TX AUDIO OUT
RX AUDIO IN
PATCHING
TX AUDIO OUT
RX AUDIO IN
RX AUDIO IN
TX AUDIO OUT
TX DATA
TX CLOCK
RX DATA
RX CLOCK
DATA KEYLINE/RTS
DSR
BA
DA
BB
DD
CA
CC
LINE MODEM 2
TX AUDIO OUT
RX AUDIO IN
PATCHING
TX AUDIO OUT
RX AUDIO IN
RX AUDIO IN
TX AUDIO OUT
DATA KEYLINE A
CHAN BUSY A
OM-43A XMT A
OM-43A LOOP BACK A
DATA KEYLINE B
CHAN BUSY B
CHAN QUAL MON (PRI)
OM-43A XMT B
OM-43A LOOP BACK B
REMOTE MODEM A STATUS
REMOTE MODEM B STATUS
CHAN QUAL MON (SEC)
VFCT
TX AUDIO OUT
RX AUDIO IN
RX AUDIO IN
TX AUDIO OUT
VFCT
TLCF AREA
WIRE LINES

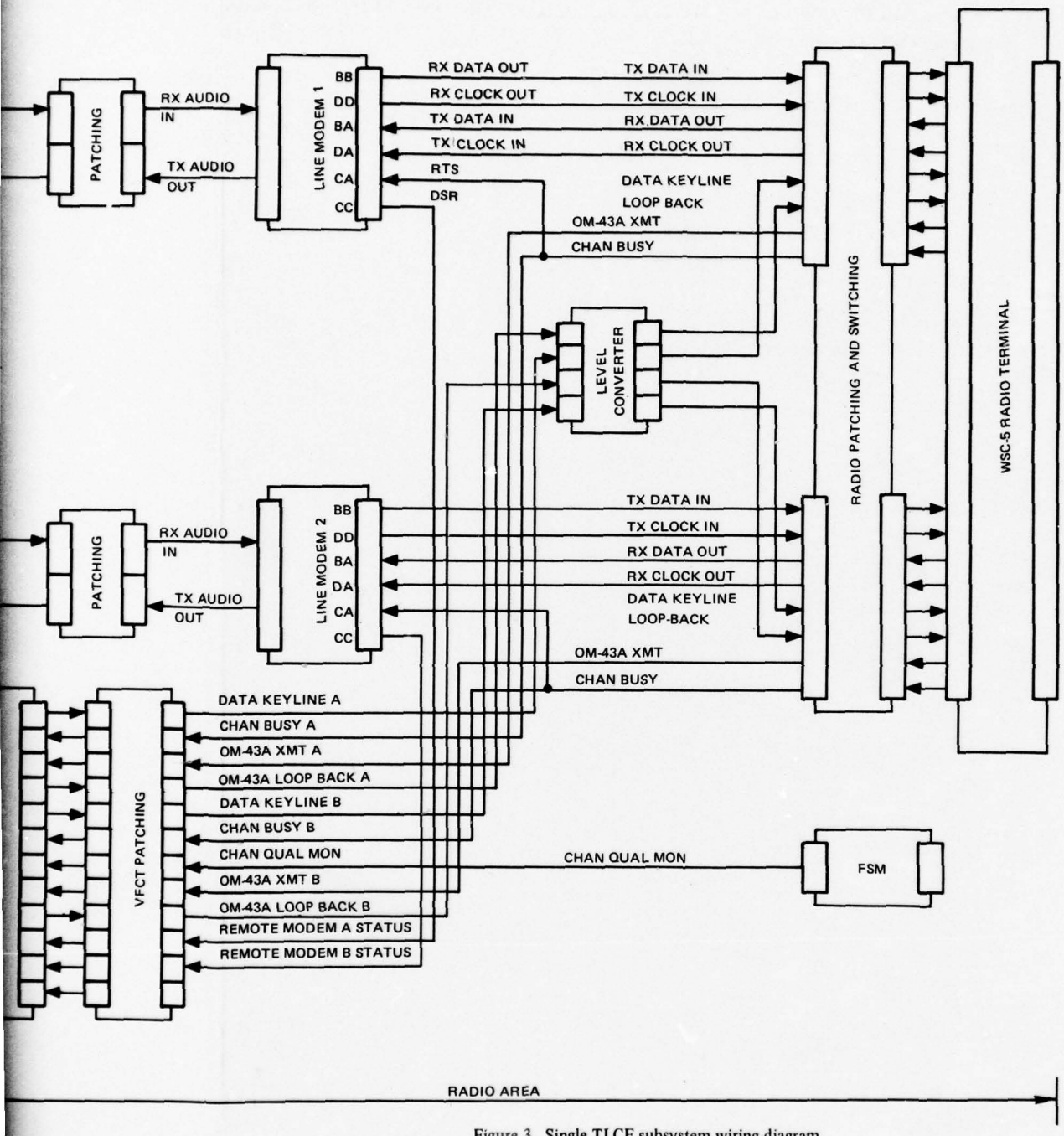
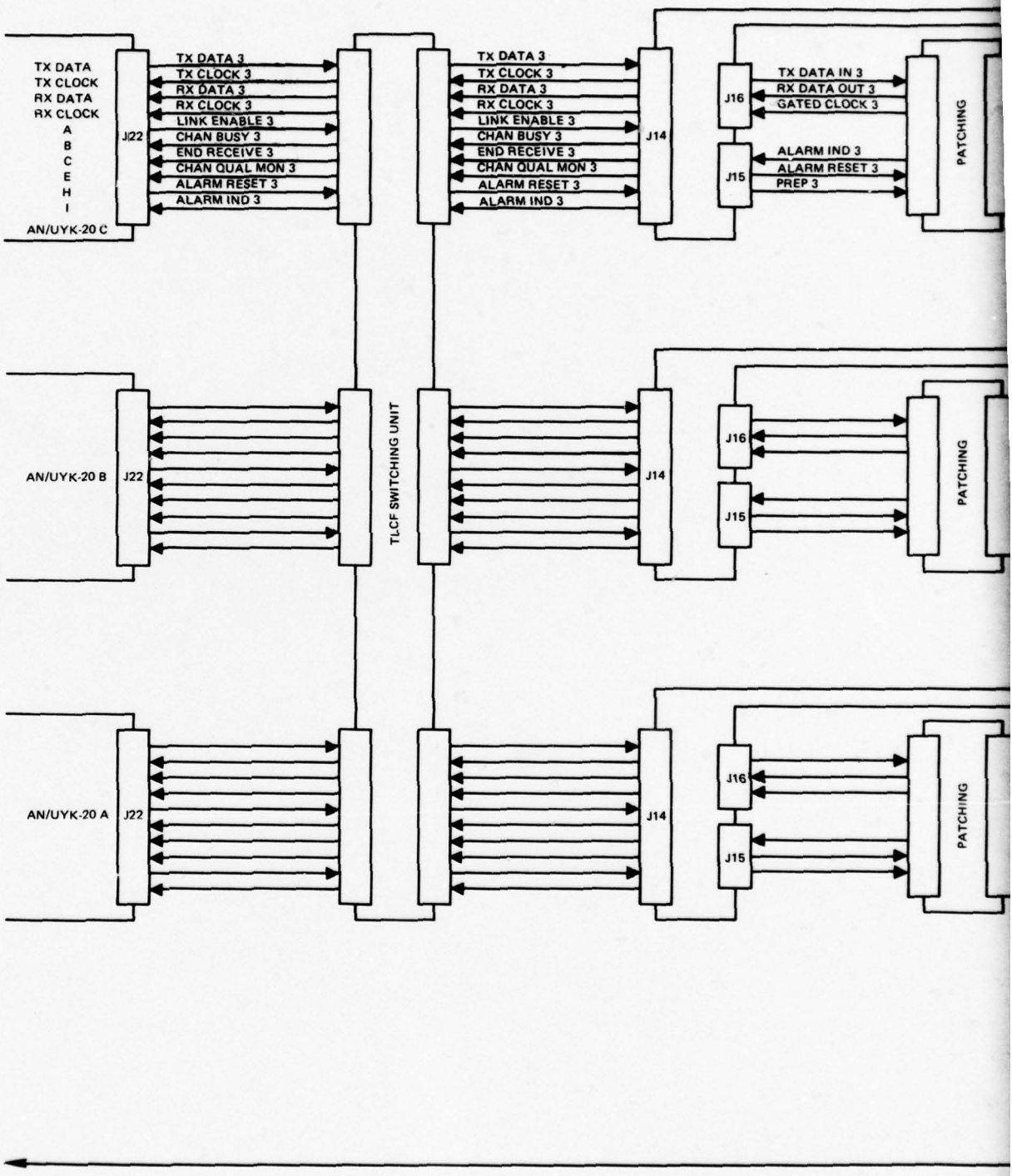
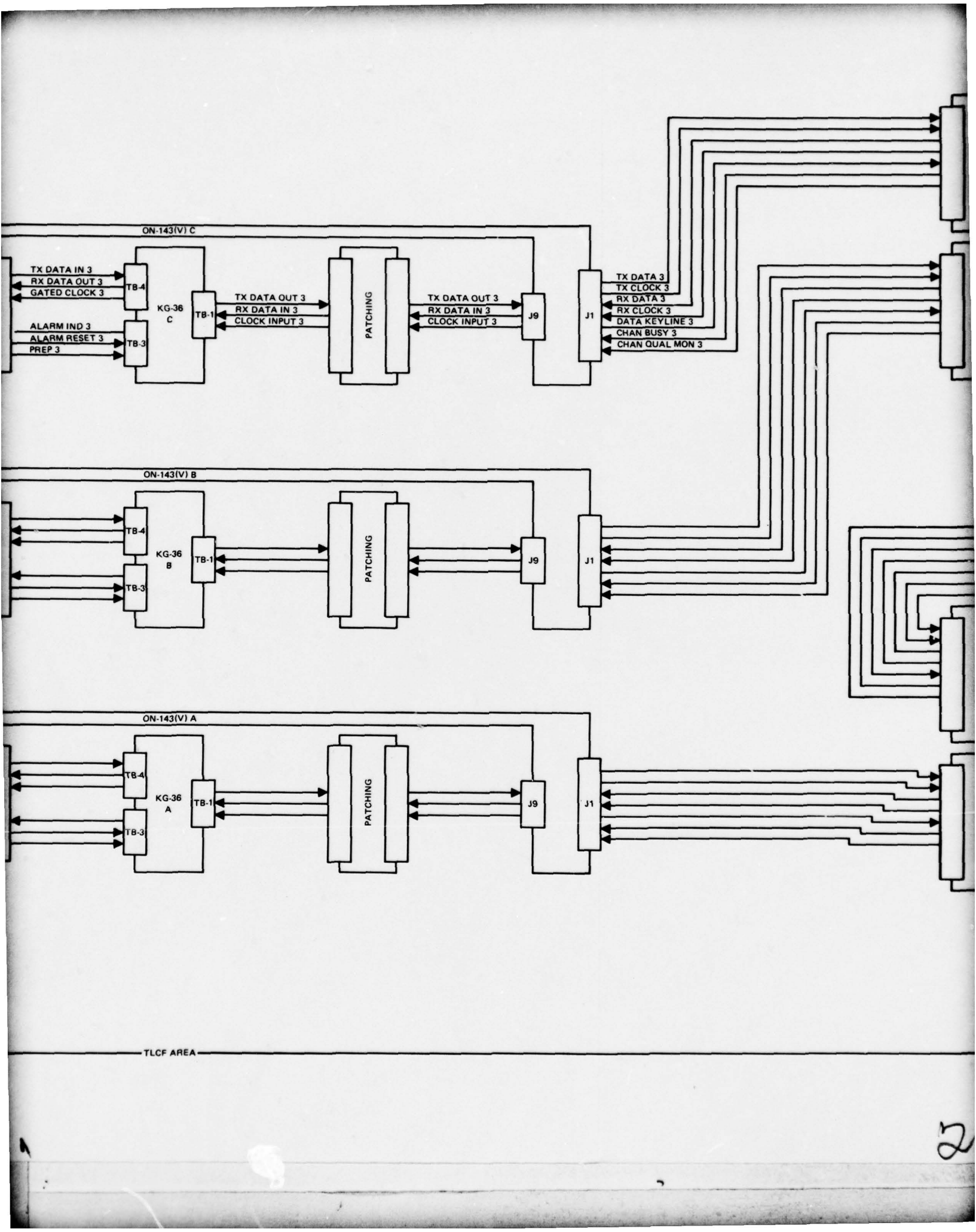
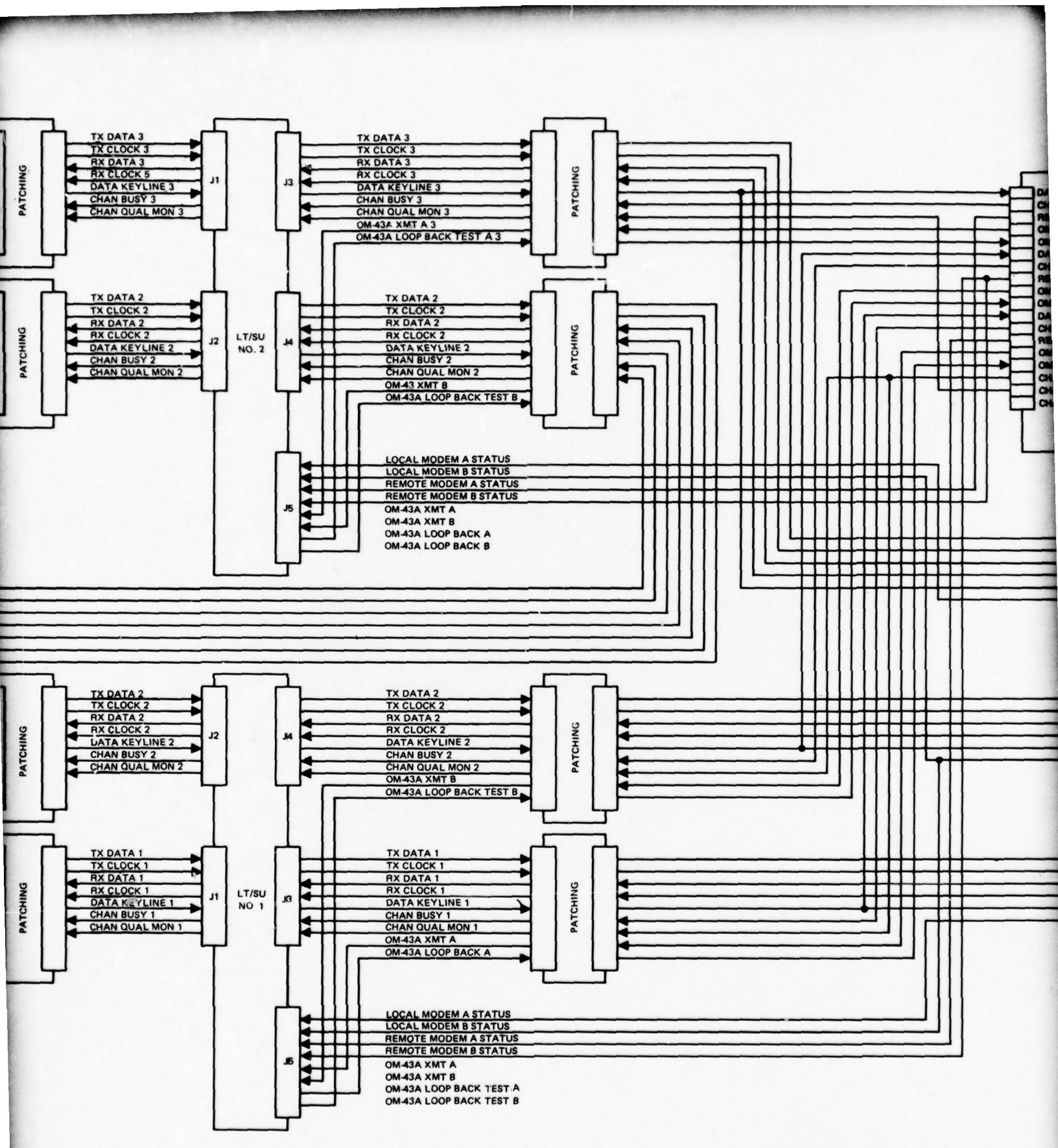
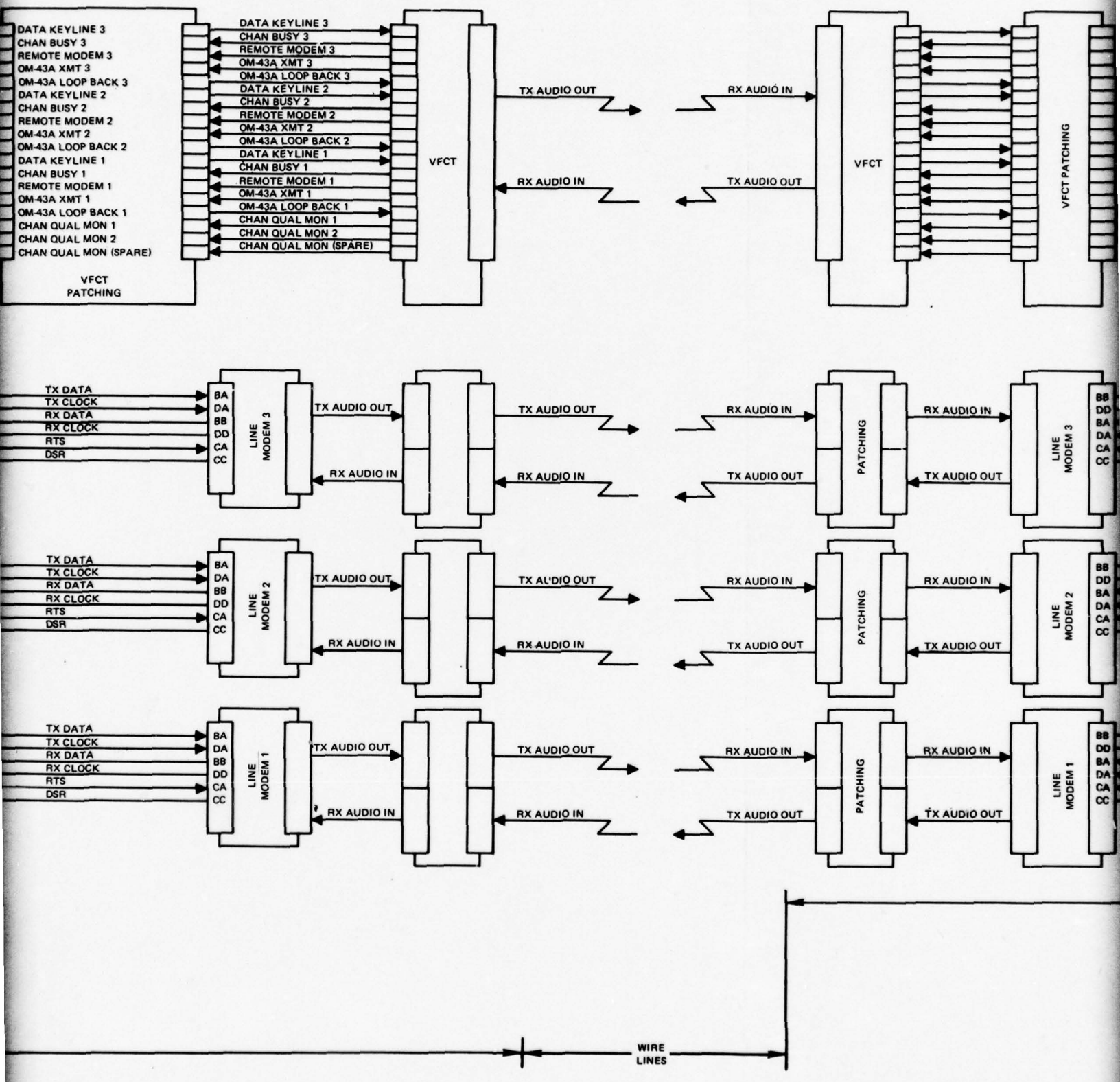


Figure 3. Single TLCF subsystem wiring diagram.


TX DATA
TX CLOCK
RX DATA
RX CLOCK
A
B
C
E
H
I
AN/UYK-20 C
J22
TX DATA 3
TX CLOCK 3
RX DATA 3
RX CLOCK 3
LINK ENABLE 3
CHAN BUSY 3
END RECEIVE 3
CHAN QUAL MON 3
ALARM RESET 3
ALARM IND 3
TX DATA 3
TX CLOCK 3
RX DATA 3
RX CLOCK 3
LINK ENABLE 3
CHAN BUSY 3
END RECEIVE 3
CHAN QUAL MON 3
ALARM RESET 3
ALARM IND 3
J14
J16
TX DATA IN 3
RX DATA OUT 3
GATED CLOCK 3
J15
ALARM IND 3
ALARM RESET 3
PREP 3
PATCHING
AN/UYK-20 B
J22
TLCF SWITCHING UNIT
J14
J16
J15
PATCHING
AN/UYK-20 A
J22
J14
J16
J15
PATCHING


ON-143(V) C
TX DATA IN 3
RX DATA OUT 3
GATED CLOCK 3
ALARM IND 3
ALARM RESET 3
PREP 3
TB-4
TB-3
KG-36
C
TB-1
TX DATA OUT 3
RX DATA IN 3
CLOCK INPUT 3
PATCHING
TX DATA OUT 3
RX DATA IN 3
CLOCK INPUT 3
J9
J1
TX DATA 3
TX CLOCK 3
RX DATA 3
RX CLOCK 3
DATA KEYLINE 3
CHAN BUSY 3
CHAN QUAL MON 3
ON-143(V) B
TB-4
TB-3
KG-36
B
TB-1
PATCHING
J9
J1
ON-143(V) A
TB-4
TB-3
KG-36
A
TB-1
PATCHING
J9
J1
TLCF AREA


PATCHING
TX DATA 3
TX CLOCK 3
RX DATA 3
RX CLOCK 5
DATA KEYLINE 3
CHAN BUSY 3
CHAN QUAL MON 3
J1
J3
TX DATA 3
TX CLOCK 3
RX DATA 3
RX CLOCK 3
DATA KEYLINE 3
CHAN BUSY 3
CHAN QUAL MON 3
OM-43A XMT A 3
OM-43A LOOP BACK TEST A 3
PATCHING
PATCHING
TX DATA 2
TX CLOCK 2
RX DATA 2
RX CLOCK 2
DATA KEYLINE 2
CHAN BUSY 2
CHAN QUAL MON 2
J2
LT/SU NO. 2
J4
TX DATA 2
TX CLOCK 2
RX DATA 2
RX CLOCK 2
DATA KEYLINE 2
CHAN BUSY 2
CHAN QUAL MON 2
OM-43 XMT B
OM-43A LOOP BACK TEST B
PATCHING
J5
LOCAL MODEM A STATUS
LOCAL MODEM B STATUS
REMOTE MODEM A STATUS
REMOTE MODEM B STATUS
OM-43A XMT A
OM-43A XMT B
OM-43A LOOP BACK A
OM-43A LOOP BACK B
PATCHING
TX DATA 2
TX CLOCK 2
RX DATA 2
RX CLOCK 2
DATA KEYLINE 2
CHAN BUSY 2
CHAN QUAL MON 2
J2
J4
TX DATA 2
TX CLOCK 2
RX DATA 2
RX CLOCK 2
DATA KEYLINE 2
CHAN BUSY 2
CHAN QUAL MON 2
OM-43A XMT B
OM-43A LOOP BACK TEST B
PATCHING
PATCHING
TX DATA 1
TX CLOCK 1
RX DATA 1
RX CLOCK 1
DATA KEYLINE 1
CHAN BUSY 1
CHAN QUAL MON 1
J1
LT/SU NO 1
J3
TX DATA 1
TX CLOCK 1
RX DATA 1
RX CLOCK 1
DATA KEYLINE 1
CHAN BUSY 1
CHAN QUAL MON 1
OM-43A XMT A
OM-43A LOOP BACK A
PATCHING
J5
LOCAL MODEM A STATUS
LOCAL MODEM B STATUS
REMOTE MODEM A STATUS
REMOTE MODEM B STATUS
OM-43A XMT A
OM-43A XMT B
OM-43A LOOP BACK TEST A
OM-43A LOOP BACK TEST B
TLCF AREA


DATA KEYLINE 3
CHAN BUSY 3
REMOTE MODEM 3
OM-43A XMT 3
OM-43A LOOP BACK 3
DATA KEYLINE 2
CHAN BUSY 2
REMOTE MODEM 2
OM-43A XMT 2
OM-43A LOOP BACK 2
DATA KEYLINE 1
CHAN BUSY 1
REMOTE MODEM 1
OM-43A XMT 1
OM-43A LOOP BACK 1
CHAN QUAL MON 1
CHAN QUAL MON 2
CHAN QUAL MON (SPARE)
VFCT PATCHING
VFCT
TX AUDIO OUT
RX AUDIO IN
RX AUDIÓ IN
TX AUDIO OUT
VFCT PATCHING
TX DATA
TX CLOCK
RX DATA
RX CLOCK
RTS
DSR
BA
DA
BB
DD
CA
CC
LINE MODEM 3
LINE MODEM 2
LINE MODEM 1
PATCHING
WIRE LINES

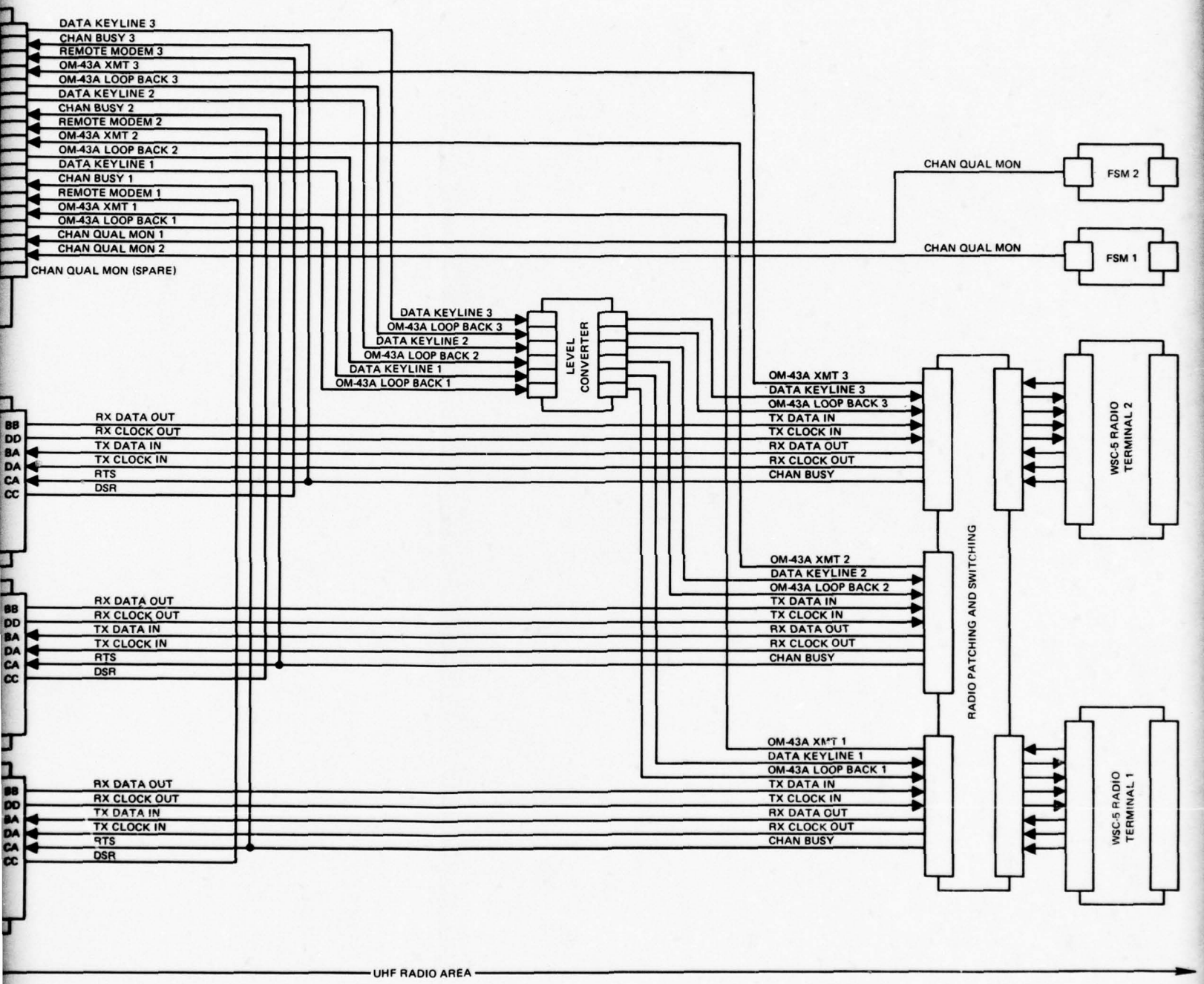


Figure 4. Detailed dual TLCF subsystem wiring diagram.

3.4.3.2 The LT/SU MONITOR mode of operation configures the TLCF subsystem area such that the selected subscriber ON-143 IG monitors the TLCF subsystem's transmission. The subscriber is prevented from transmitting by electronic switching within the LT/SU.

3.4.3.3 The LT/SU BACK-TO-BACK mode of operation configures the TLCF subsystem area such that LT/SU port J1 transmit lines are connected to LT/SU port J2 receive lines, and LT/SU port J2 transmit lines are connected to LT/SU port J1 receive lines (eg, TX DATA to RX DATA, TX CLOCK to RX CLOCK, and DATA KEYLINE to CHANNEL BUSY). This configuration allows the TLCF subsystem to communicate with the simulated subscriber subsystem within the TLCF subsystem area without going on-line with the uhf radio and satellite.

3.4.3.4 The LT/SU TEST mode of operation configures the TLCF subsystem area such that the TLCF subsystem remains on-line with the uhf radio. The selected subscriber subsystem is also allowed to be on-line with the uhf radio (with no transmit restrictions), and thereby serves as an operational on-line subscriber. TEST A mode of operation configures the TLCF subsystem area to communicate with uhf radio via the line modem connected to the LT/SU port J3. Test B mode of operation configures the TLCF subsystem area to communicate with the uhf radio via the line modem connected to LT/SU port J4.

3.4.4 With reference to figures 3 and 4, the OM-43A LOOP BACK TEST connects transmit data to receive data within the uhf OM-43A modem during the period of time that the TLCF subsystem or subscriber subsystem is transmitting. "A" will command uhf OM-43A modem A to loop back, while "B" will command uhf OM-43A modem B to loop back.

3.4.5 The local line modem and remote line modem status indicators on the LT/SU provide the operator with information as to which line modems are operational. The OM-43A XMT and RCV status indicators on the LT/SU provide visual indication of rf link activity.

3.4.6 The complexity of the TLCF subsystem design demands that as much feedback as possible be given to the TLCF operator to demonstrate that the system is functioning properly. This requirement is also accompanied by the need to bring a "downed" system back to an operational state in the shortest possible time (low MTTR). The TLCF subsystem LT/SU and system patching fulfills these requirements. The different system configurations selectable by the LT/SU, along with the visual indication of rf link activity provided by the OM-43A XMT and RCV status indicators, allow rapid troubleshooting of rf system operating difficulties at a "flick of the switch". Thus, if the TLCF has lost contact with its subscribers in the NORMAL mode of operation but the BACK-TO-BACK mode functions correctly, then the problem has been isolated beyond the TLCF equipment area. Positive troubleshooting can then proceed without doubt as to where the problem area is.

3.4.7 Appendix A lists LT/SU connector-pin assignments.

3.5 Line Modems

3.5.1 A line modem (modulator – demodulator) must be utilized to remote baseband digital data and clock information when the uhf radio area is remotely located from the TLCF subsystem area. Digital baseband transmit data and transmit clock signals to be transmitted to the remote point are modulated into an audio signal which can be transmitted over type 3002 private lines with C2 conditioning. This audio signal is normally a four-phase synchronous signal produced by a 201-type compatible data set. The remote modem then demodulates the audio signal back into a digital baseband data and clock signal. The remote site will be the uhf radio area or the TLCF subsystem area, depending on whether the transmit data and clock signal are going to the subscriber (to the satellite) or coming from the subscriber (from the satellite), respectively.

3.5.2 The audio output of the line modems (the carrier) shall be controlled by request-to-send. This will enable the remote receive line modems to resynchronize within a few milliseconds (eg, 9 ms) on an envelope step shift of the quadrature phase-shifted audio signal produced by the transmitting line modems. The transmitting line modem will transmit this envelope step shift each time its input is presented with a new digital clock signal, which is a step shift from the previous clock. This step shift in the clock occurs in the receive clock output from the uhf OM-43A radio modem (transmit clock to the line modem) when different subscriber signals are received. The step shift also occurs in the TLCF subsystem transmit line modem transmit clock.

3.5.3 The uhf radio area line modem request-to-send is controlled by the uhf OM-43A radio modem output data transfer signal line (ie, channel busy). The TLCF subsystem area line modem request-to-send is controlled by a low-level data keyline.

3.5.4 Appendix A lists standard line modem RS-232 connector-pin assignments.

3.6 Voice Frequency Carrier Terminal, VFCT

3.6.1 Voice frequency carrier terminals, VFCTs, will suffice to remote TLCF status and control lines. Voice frequency carrier terminals commonly have 16 low-speed send channels and 16 low-speed receive channels. These are multiplexed into an audio signal and remoted by a four-wire, full-duplex audio line. One such VFCT is the FCC-67.

3.6.2 The status and control lines of table 2 and table 4 are low-data-rate signals. High-data-rate line modems are not required to remote these signals between the TLCF subsystem equipment area and the uhf radio area. Type C line requirements of table 3 and table 5 indicate that VFCT status and control line outputs must not be delayed more than 15 milliseconds from the VFCT status and control-line inputs.

Table 2. Single TLCF subsystem lines that require remoting.

Line Nomenclature	Function	Qty	Type
Transmit/receive A data and clock	DATA/CLOCK	1	a
Data keyline, A	CONTROL	1	b
Chan busy, A	CONTROL/STATUS	1	c
OM-43A XMT A	STATUS	1	c
OM-43A loop back, A	CONTROL	1	b
Chan qual mon, primary	STATUS	1	c
Remote modem A status	STATUS	1	c
Transmit/receive B data and clock	DATA/CLOCK	1	a
Data keyline, B	CONTROL	1	b
Chan busy, B	CONTROL/STATUS	1	c
OM-43A XMT B	STATUS	1	c
OM-43A loop back B	CONTROL	1	b
Chan qual mon, secondary	STATUS	1	c
Remote modem B status	STATUS	1	c

Table 3. Single TLCF remoting line types and specifications.

Type	Qty Req'd	Line Requirements
a	2	This circuit is to be a full-duplex, four-wire-balanced, 600-ohm, type 3002-C2 conditioned transmit and receive telephone line or equivalent, with less than 16-dBm loss and less than 25-Hz translation, and capable of supporting the selected 2400-baud data modem. This circuit is to be a full-period (dedicated) circuit from the TLCF subsystem area to the remote uhf radio area.
b	4	This line is to be a full-period (dedicated) transmit line from the TLCF subsystem area to the remote uhf radio area. This line must accept an input from a MIL-STD 188C single-ended output from the TLCF subsystem area of positive 6 volts or negative 6 volts. A negative 6-volt input must produce a uhf radio area single-ended output which is an open circuit with not less than 50000 ohms to ground. A positive 6-volt input must produce a uhf radio area single-ended output which is at ground potential with not more than 0.5 ohm to ground. If a relay is used to achieve this type of output, then contact bounce must not exceed 5 milliseconds, and operation time must not exceed 6 milliseconds. Delay time for the output to produce a solid ground condition after the input makes the transition to positive 6 volts shall not exceed 15 milliseconds. This circuit is normally implemented by a VFCT circuit followed by a "low-level load" relay.
c	8	This line is to be a full-period (dedicated) receive line from the remote uhf radio area to the TLCF subsystem area. Inputs to this line are derived from the remote uhf radio area equipment's single-ended outputs. These outputs may range from positive 3 volts to positive 15 volts or from negative 3 volts to negative 15 volts. The output of this line must be a MIL-STD 188C single-ended output of positive 6 volts if the input is positive 3 – 15 volts and must be negative 6 volts if the input is negative 3 – 15 volts. Delay time for the output to produce a transition from negative 6 volts to positive 6 volts after the input makes the transition to positive 6 volts shall not exceed 15 milliseconds. This circuit is normally implemented by a complementary VFCT circuit.

Table 4. Dual TLCF subsystem lines requiring remoting.

Line Nomenclature	Function	Qty	Type
Transmit/receive 1 data/clock	DATA AND CLOCK	1	a
Data keyline 1	CONTROL	1	b
Channel busy 1	CONTROL/STATUS	1	c
OM-43A XMT 1	STATUS	1	c
OM-43A loop back 1	CONTROL	1	b
Chan qual mon 1	STATUS	1	c
Remote modem 1 status	STATUS	1	c
Transmit/receive 2 data/clock	DATA AND CLOCK	1	a
Data keyline 2	CONTROL	1	b
Channel busy 2	CONTROL/STATUS	1	c
OM-43A XMT 2	STATUS	1	c
OM-43A loop back 2	CONTROL	1	b
Chan qual mon 2	STATUS	1	c
Remote modem 2 status	STATUS	1	c
Transmit/receive 3 data/clock	DATA AND CLOCK	1	a
Data keyline 3	CONTROL	1	b
Channel busy 3	CONTROL/STATUS	1	c
OM-43A XMT 3	STATUS	1	c
OM-43A loop back 3	CONTROL	1	b
Chan qual mon 3	STATUS	1	c
Remote modem 3 status	STATUS	1	c

Table 5. Dual TLCF remoting line types and specifications.

Type	Qty Req'd	Line Requirements
a	3	This circuit is to be a full-duplex, four-wire-balanced, 600-ohm, type 3002-C2 conditioned transmit and receive telephone line or equivalent, with less than 16-dBm loss and less than 25-Hz translation, and capable of supporting the selected 2400-baud data modem. This circuit is to be a full-period (dedicated) circuit from the TLCF subsystem area to the remote uhf radio area.
b	6	This line is to be a full-period (dedicated) transmit line from the TLCF subsystem area to the remote uhf radio area. This line must accept an input from a MIL-STD 188C single-ended output from the TLCF subsystem area of positive 6 volts or negative 6 volts. A negative 6-volt input must produce a uhf radio area single-ended output which is an open circuit with not less than 50000 ohms to ground. A positive 6-volt input must produce a uhf radio area single-ended output which is at ground potential with not more than 0.5 ohm to ground. If a relay is used to achieve this type of output, then contact bounce must not exceed 5 milliseconds, and operation time must not exceed 6 milliseconds. Delay time for the output to produce a solid ground condition after the input makes the transition to positive 6 volts shall not exceed 15 milliseconds. This circuit is normally implemented by a VFCT circuit followed by a "low-level load" relay.

Table 5. Dual TLCF remoting line types and specifications (Continued).

Type	Qty Req'd	Line Requirements
c	12	This line is to be a full-period (dedicated) receive line from the remote uhf radio area to the TLCF subsystem area. Inputs to this line are derived from the remote uhf radio area equipment's single-ended outputs. These outputs may range from positive 3 volts to positive 15 volts or from negative 3 volts to negative 15 volts. The output of this line must be a MIL-STD 188C single-ended output of positive 6 volts if the input is positive 3-15 volts and must be negative 6 volts if the input is negative 3-15 volts. Delay time for the output to produce transition from negative 6 volts to positive 6 volts after the input makes the transition to positive 6 volts shall not exceed 15 milliseconds. This circuit is normally implemented by a VFCT circuit.

3.7 Uhf Radio Subsystem

3.7.1 The uhf radio subsystem consists of an interface group, a modem group, a radio set group, and the antenna group. These equipments comprise a subsystem which will allow a baseband digital signal to be modulated into a DPSK rf signal that can be transmitted to a subscriber's AN/WSC-3(V) receiver via the satellite. This subsystem will likewise receive and demodulate a DPSK rf signal which originates from a subscriber's AN/WSC-3 transmitter.

3.7.2 The interface group consists of a baseband interface unit, a data switchboard, and a control and indicator switchboard. The interface group interfaces the baseband digital signal with the OM-43A modem.

3.7.3 The modem group consists of OM-43A/USC modems. The modem modulates the baseband digital signal into a 70-MHz DPSK signal for processing by the radio set group during its transmit mode. The modem demodulates the 70-MHz DPSK signal from the radio set group into a baseband digital signal for processing by the baseband interface unit when the radio set group is in the receive mode of operation.

3.7.4 The AN/WSC-5(V) radio set group up-converts and amplifies the 70-MHz DPSK signal into the uplink frequency and power level at which the radio set group is set to transmit. The AN/WSC-5(V) radio set group down-converts the downlink frequency signal into a 70-MHz DPSK signal which is processed by the OM-43A/USC modem when the radio set group is receiving. If the uhf radio system is in the full-duplex mode of operation, it can transmit and receive simultaneously.

3.7.5 The antenna group is positioned such that its main beam is pointing to the satellite which serves the TLCF subscriber net. The antenna radiates the transmit rf signal to satellite and/or receives a weak rf signal from the satellite.

3.8 Fleet Satellite Communications Spectrum Monitor System, FSM

3.8.1 The FSM can monitor the satellite channels being used, how often a frequency is used, the type of user on the satellite, and the power levels involved. It can look at the satellite spectrum and determine the characteristics of unauthorized signals as well as determine whether the satellite or ground terminal is degrading. In TACINTEL, the FSM will supply the TLCF subsystem with a channel quality monitor status line. The TLCF DPS uses this status line to determine whether the rf link is acceptable.

4.0 TLCF rf LINK REMOTING CONSIDERATIONS

4.1 In some single TLCF subsystem configurations and the dual TLCF subsystem configurations, the equipment may be remotely located from the uhf radio area. The TLCF subsystem equipment may be many miles distant from the uhf radio equipment area. Status lines, control lines, and data lines allow the TLCF equipment to talk with the uhf radio equipment and, thus, the subscriber net. These lines must be remoted when the TLCF subsystem is separated from the uhf radio area by a large distance.

4.2 Figure 3 gives the detailed single TLCF subsystem wiring diagram for a remoted system. The data, control, and status lines associated with the two line modems and the VFCT must be remoted. These lines are presented in table 2. The remoted lines fall into three categories: type a, type b, and type c. Table 3 defines and lists specifications for the three types of lines. Appendix B defines the lines called out in figure 3.

4.3 Figure 4 gives the detailed dual TLCF subsystem wiring diagram for a remoted system. The data, control, and status lines associated with the three line modems and the VFCT must be remoted. These lines are presented in table 4. The remoted lines fall into three categories: type a, type b, and type c. Table 5 defines and lists specifications for the three types of lines. Appendix B defines the lines called out in figure 4.

5.0 REMOTING LINE ROUTING AND PATCHING PHILOSOPHY

5.1 The equipment and remoting line configuration given in figures 3 and 4 must be implemented if system reliability and system availability requirements are to be met. The remoting lines which serve as backup lines to the primary lines may be called "spare", "secondary", or "redundant" remoting lines. In figure 3, "B" lines serve as backup. In figure 4, "2" lines serve as backup where "1" and "3" lines serve as primary lines. 1, 2, and 3 lines can be considered as separate "sets" of lines. It is important that these sets have as few common nodes as possible. It is for this reason that the backup set of remoting lines should be diversely routed.

5.2 Figures 3 and 4 show that backup data remoting paths exist in both the single and dual TLCF subsystem. Note that status and command lines such as "REM A" and "REM B" modem status and OM-43A LOOP BACK "TEST A" and "TEST B" exist. These remoting lines, although they enhance system availability and lower MTTR, are not essential to TLCF system operation. These functions can therefore be removed and their remoting lines patched into the system to replace a faulty essential line. The essential remoting lines required per TLCF subsystem are as follows:

- Transmit data
- Receive data
- Data keyline
- Channel busy.

These lines must be present for rf system operation.

5.3 The detailed TLCF subsystem wiring diagrams of figures 3 and 4 reveal that patch panels exist among all equipments. Patching under normal conditions will not be needed, but will be incorporated to reduce MTTR should equipment or remoting lines fail. Patch panels will be implemented such that patching equipment can be accomplished with a single patch. This mandates the use of multicontact (eg, 12-contact) patch panels for the ON-143 IG, LT/SU, and line modems. The patching for the ON-143 IG side and line modem side of the LT/SU should be identical in connector-pin assignment. This will allow bypassing of the LT/SU entirely, should it become necessary.

6.0 RECOMMENDATIONS

6.1 The maximum capacitive loading presented to an output driver in the KG-36 crypto, the ON-143 IG, and LT/SU shall not exceed 2500 pF, and the minimum load resistance shall be 3 kΩ. This loading will be the combined impedance of cabling and input receiver circuitry. The loading requirement allows for a ±3-volt transition region on the input signal.

6.2 System grounding philosophy mandates that all signal returns must be carried through from equipment to equipment without grounding. The returns may be commoned at one contact at the multipatch panels if need be, but they must be carried through the patching panel and they must *not* be grounded. Use of a common ground bus in equipment racks for signal returns is *not* allowed. *Only one end* of cable shields on interconnecting cables is to be grounded if signal returns are at chassis ground potential within the individual equipments. This will help alleviate ground loops caused by multiple grounding points.

6.3 Remoting of system control lines must be accomplished such that ±6-volt transmit signals arrive as clean ±6-volt receive signals. This prohibits the use of "wire only" in any remoting other than very short "in-house" distances, unless the signals are converted to high level (ie, 110 Vdc, 60 mA). VFCTs or multiplexed line modems are generally used for remoting control lines.

6.4 Care must be taken when defining the terms "transmit", "receive", "output", and "input". "Transmit" must not be confused with "output". Line nomenclature should be assigned such that it defines what the function is and whether the line is connected to a driver (an output) or a receiver (an input). This can be exemplified by following the nomenclature for data transmitted to the subscriber via satellite from the TLCF subsystem. The transmit data originate from the TLCF AN/UYK-20 DPS and are encrypted by the KG-36 crypto; ie, transmit data input on the red side and transmit data output on the black side of the crypto. These Transmit Data are an output of the ON-143 IG J1, an input to the LT/SU J1/J2, an output of the LT/SU J3/J4, and an input to the TLCF subsystem area line modem. It often happens that these signal lines are crossed (driver against driver) by the most experienced personnel if care is not exercised.

APPENDIX A

TLCF EQUIPMENT CONNECTOR-PIN ASSIGNMENTS

AN/UYK-20X(V)* DPS and ON-143(V)/USQ Interconnecting Group rf Link connector-pin assignments.

Function	AN/UYK-20	ON-143	
		Signal	Return
Transmit clock	B5	J14-L	J14-M
Transmit data	A5	J14-J	J14-K
Receive clock	A7	J14-R	J14-S
Receive data	B7	J14-N	J14-P
"A" (LINK ENABLE)	G4	J14-T	J14-U
"B" (CHANNEL BUSY)	D12	J14-V	J14-W
"C" (END RECEIVE)	C12	J14-X	J14-Y
"E" (CHAN QUAL MON)	G1	J14-b	J14-c
"H" (ALARM RESET)	G2	J14-h	J14-i
"I" (ALARM INDICATE)	D11	J14-j	J14-k
SIGNAL GROUND	A6 & A8		

*The pin assignment listed here is for an odd channel; ie, channel 13_8 188C synchronous I/O. It is different for an even channel.

ON-143(V)/USQ Interconnecting Group and KG-36 Crypto rf Link connector-pin assignments.

Function	ON-143 J15	ON-143 J16	KG-36	ON-143 J9
ALARM INDICATE	L	–	TB3-10	–
ALARM INDICATE RTN	M	–	TB3-5	–
$\overline{\text{MESSAGE INDICATE ALARM RESET}}$	N	–	TB3-8	–
$\overline{\text{MESSAGE INDICATE ALARM RESET}}$ RTN	P	–	TB3-5	–
$\overline{\text{PREP}}$	R	–	TB3-4	–
$\overline{\text{PREP}}$ RTN	S	–	TB3-5	–
TRANSMIT DATA IN (TDI)	–	G	TB4-5	–
TRANSMIT DATA IN (TDI) RTN	–	H	TB4-7	–
RECEIVE DATA OUT (RDO)	–	J	TB4-9	–
RECEIVE DATA OUT (RDO) RTN	–	K	TB4-10	–
GATED CLOCK	–	R	TB4-1	–
GATED CLOCK RTN	–	S	TB4-3	–
CLOCK	–	–	TB1-1	T
CLOCK RTN	–	–	TB1-3	U
TRANSMIT DATA OUT (TDO)	–	–	TB1-9	V
TRANSMIT DATA OUT (TDO) RTN	–	–	TB1-10	W
RECEIVE DATA IN (RDI)	–	–	TB1-5	X
RECEIVE DATA IN (RDI) RTN	–	–	TB1-7	Y

ON-143(V)/USQ rf Link connector-pin assignments (partial).

Function	ON-143
DATA KEYLINE OUT (LOW-LEVEL)	J1-5
DATA KEYLINE OUT (LOW-LEVEL) RTN	J1-6
CHANNEL QUALITY MONITOR	J1-7
CHANNEL QUALITY MONITOR RTN	J1-8
DATA KEYLINE (SUPPLIES GROUND IN XMT, NOT USED WHEN REMOTING)	J1-33
OUTPUT DATA TRANSFER (CHAN BUSY)	J1-35
TRANSMIT DATA	J1-42
TRANSMIT DATA RTN	J1-43
RECEIVE DATA	J1-67
RECEIVE DATA RTN	J1-68
TRANSMIT CLOCK	J1-70
TRANSMIT CLOCK RTN	J1-71
RECEIVE CLOCK	J1-76
RECEIVE CLOCK RTN	J1-77

Link Test/Status Unit connector-pin assignments.

J1	A	TX1 DATA	Input to LT/SU fm ON-143
	B	TX1 DATA RTN	
	C	TX1 CLOCK	Input to LT/SU fm ON-143
	D	TX1 CLOCK RTN	
	E	RX1 DATA	Output to ON-143 fm LT/SU
	F	RX1 DATA RTN	
	G	RX1 CLOCK	Output to ON-143 fm LT/SU
	H	RX1 CLOCK RTN	
	I	KEY1	Data keyline; input to LT/SU fm ON-143
	J	KEY1 RTN	
	K	BUSY1	Channel busy/output data transfer; output to ON-143 from LT/SU
	L	BUSY1 RTN	
	M	CHN QLT MON1	Channel quality monitor; output on ON-143 fm LT/SU
	N	CHN QLT MON1 RTN	
J3	A	TX1′ DATA	Output to line modem from LT/SU
	B	TX1′ DATA RTN	
	C	TX1′ CLOCK	Output to line modem from LT/SU
	D	TX1′ CLOCK RTN	
	E	RX1′ DATA	Input to LT/SU fm line modem
	F	RX1′ DATA RTN	
	G	RX1′ CLOCK	Input to LT/SU fm line modem
	H	RX1′ CLOCK RTN	
	I	KEY1′	Data keyline; output to VFCT and line modem fm LT/SU
	J	KEY1′ RTN	
	K	BUSY1′	Channel busy/output data transfer; input to LT/SU fm VFCT
	L	BUSY1′ RTN	
	M	CHN QLT MON1′	Channel quality monitor; input LT/SU fm VFCT
	N	CHN QLT MON1′ RTN	

Link Test/Status Unit connector-pin assignments (Continued).

J2	A	TX2 DATA	Input to LT/SU fm ON-143
	B	TX2 DATA RTN	
	C	TX2 CLOCK	Input to LT/SU fm ON-143
	D	TX2 CLOCK RTN	
	E	RX2 DATA	Output to ON-143 fm LT/SU
	F	RX2 DATA RTN	
	G	RX2 CLOCK	Output to ON-143 fm LT/SU
	H	RX2 CLOCK RTN	
	I	KEY2	Data keyline; input to LT/SU fm ON-143
	J	KEY2 RTN	
	K	BUSY2	Channel busy/output data transfer; output to ON-143 fm LT/SU
	L	BUSY2 RTN	
	M	CHN QLT MON2	Channel quality monitor; output to ON-143 fm LT/SU
	N	CHN QLT MON2 RTN	
J4	A	TX2′ DATA	Output to line modem from LT/SU
	B	TX2′ DATA RTN	
	C	TX2′ CLOCK	Output to line modem from LT/SU
	D	TX2′ CLOCK RTN	
	E	RX2′ DATA	Input to LT/SU fm line modem
	F	RX2′ DATA RTN	
	G	RX2′ CLOCK	Input to LT/SU fm line modem
	H	RX2′ CLOCK RTN	
	I	KEY2′	Data keyline; output to VFCT and line modem fm LT/SU
	J	KEY2′ RTN	
	K	BUSY2′	Channel busy/output data transfer; input to LT/SU fm VFCT
	L	BUSY2′ RTN	
	M	CHN QLT MON2′	Channel quality monitor; input to LT/SU fm VFCT
	N	CHN QLT MON2′ RTN	

Link Test/Status Unit connector-pin assignments (Continued).

J5	A	Local line modem A status
	B	Local line modem A status RTN
	C	Local line modem B status
	D	Local line modem B status RTN
	E	Remote line modem A status
	F	Remote line modem A status RTN
	G	Remote line modem B status
	H	Remote line modem B status RTN
	J	OM-43A XMT-A
	K	OM-43A XMT-A RTN
	L	OM-43A XMT-B
	M	OM-43A XMT-B RTN
	N	OM-43A loop-back test A
	P	OM-43A loop-back test A RTN
	R	OM-43A loop-back test B
	S	OM-43A loop-back test B RTN

RS-232 Interface connector-pin assignments.

Pin Number	Circuit	Description
1	AA	Protective ground
2	BA	Transmitted data
3	BB	Received data
4	CA	Request to send
5	CB	Clear to send
6	CC	Data set ready
7	AB	Signal ground (common return)
8	CF	Received line signal detector
9	–	(Reserved for data set testing)
10	–	(Reserved for data set testing)
11		Unassigned
12	SCF	Secondary received line signal detector
13	SCB	Secondary clear to send
14	SBA	Secondary transmitted data
15	DB	Transmission signal element timing (DCE source)
16	SBB	Secondary received data
17	DD	Receiver signal element timing (DCE source)
18		Unassigned
19	SCA	Secondary request to send
20	CD	Data terminal ready
21	CG	Signal quality detector
22	CE	Ring indicator
23	CH/CI	Data signal rate selector (DTE/DCE source)
24	DA	Transmit signal element timing (DTE source)
25		Unassigned

APPENDIX B
TLCF SYSTEM LINE DEFINITIONS

TRANSMIT DATA

Black TX data to be remoted to the radio for transmittal to subscribers originates from the KG-36 crypto device as transmit data out, TDO. TDO is forwarded through the ON-143 and link test/status unit. It is important to note that what is an output from the crypto/ON-143 is also an input to the OM-43A modem. Care must be taken not to confuse the word "transmit" with "output" or "input". In the case of transmit data, it is an "output" of the ON-143, an "input" of the TLCF subsystem line modem, an "output" of the radio area line modem and, finally, an "input" to the OM-43 uhf radio modem. Transmit data out has ±6-volt levels and remains in a mark condition; ie, +6 volts if data transfer stops. The only time that transmit data is valid is when data keyline is high; ie, +6 volts. Note that the line modem will modulate and transmit data only during the time that data keyline is +6 volts.

TRANSMIT CLOCK

Transmit clock is continuously being output from the ON-143 interconnecting group through the link test/status unit and to the TLCF line modem. Observing this clock on a scope with sync reference other than transmit clock will likely reveal sudden phase shift when channel busy (radio output data transfer) makes transitions to +6 volts from -6 volts and to -6 volts from +6 volts. During the period when data keyline is +6 volts, transmit data will be observed to make transitions on the leading edge of the TX CLOCK period. It is only during this period that this relationship need be true.

RECEIVE DATA

The data received via the satellite is remoted to the TLCF subsystem from the WSC-5 OM-43A uhf modem via line modems. Radio receive data output from the OM-43A is an input of the line modem's TRANSMITTED DATA, BA. This digital baseband signal is then modulated into an audio signal and transmitted to the TLCF receive line modem, where it is demodulated back into a digital baseband signal on the line modem's RECEIVED DATA, BB. Line modem RECEIVED DATA is transmitted to the LT/SU RX' DATA, passed through the LT/SU, and out to the ON-143 and KG-36 crypto as receive data "in." RECEIVE DATA voltage levels are ±6 volts and change on the positive transition of clock when observed at the radio, line modems, and ON-143 IG J1. Data voltage levels should remain at +6 volts (a MARK condition) when no data is being transferred. Note that data clock phase relationships are reversed from the previously discussed relationships when the KG-36 crypto is observed.

RECEIVE CLOCK

When the WSC-5 OM-43A uhf modem acquires a receive signal, it will extract receive data and receive clock from the signal. This RADIO RECEIVE CLOCK OUT is then remoted to the ON-143 interconnecting group to synchronize the ON-143 receive clock phase-lock loop circuitry. At both the OM-43A and ON-143, RX DATA should be observed to make transitions on the leading edge of RX CLOCK. The OM-43A modem will continuously generate RADIO RX CLOCK OUT. RADIO RX CLOCK OUT can be expected to have substantial jitter when observed at the radio if the OM-43A is not locked onto a receive signal. This jitter will cease when a uhf signal is acquired by the OM-43A. RADIO RX CLOCK OUT jitter will not be observed at the LINK TEST/STATUS UNIT (LT/SU), since RADIO RX CLOCK OUT and RADIO RX DATA OUT are transmitted to the LT/SU via the line modems only during the period of time that RADIO CHANNEL BUSY is at a logical "1" (ie, +6 volts) and the OM-43A is locked onto a signal. Receive clock levels are ±6 volts.

DATA KEYLINE

The ON-143 interconnecting group will raise DATA KEYLINE (a black signal) to +6 volts from -6 volts when the TLCF subsystem desires to transmit. This +6 volts DATA KEYLINE is used two places. First, it is used to control REQUEST TO SEND on the TLCF subsystems line modem; second, it is remoted to a converter at the radio side of the rf link configuration. This converter must convert the +6 volts into a contact closure which will ground a +28-volt OM-43A line and thus command the uhf radio to transmit.

BUSY/CHANNEL BUSY/OUTPUT DATA TRANSFER

When the WSC5 OM-43A uhf modem acquires a signal from the satellite, it will extract RECEIVE DATA and RECEIVE CLOCK. These signals will then be remoted to the ON-143 via the line modems. The OM-43A will raise CHANNEL BUSY to +6 volts from –6 volts when RECEIVE DATA and RECEIVE CLOCK are valid. CHANNEL BUSY will remain at +6 volts until the OM-43A loses acquisition of the satellite receive signal. CHANNEL BUSY is remoted to the TLCF subsystem LT/SU and ON-143 IG, and is also used at the uhf radio area line modem to control REQUEST TO SEND. "CHANNEL BUSY" is identical to "BUSY" and "OUTPUT DATA TRANSFER," and this nomenclature is used interchangeably.

"REQUEST TO SEND"

When REQUEST TO SEND goes to +6 volts from –6 volts, the line modem is informed that a user wants to transmit baseband digital information to a remote line modem. The TLCF subsystem line modem REQUEST TO SEND is controlled by DATA KEYLINE, whereas the remote line modem's RTS is controlled by CHANNEL BUSY.

CHANNEL QUALITY MONITOR

CHN QLT MON originates from the FLEET SATCOM MONITOR, FSM. A value of +6 volts indicates that rf link quality is poor, and –6 volts indicates an acceptable rf link. CHN QLT MON is remoted to the ON-143 Interconnecting Group via VFCTs.

DATA SET READY

This signal is generated by the line modems and indicates that it is powered on and ready to receive and transmit data. Definitions for "LOC A" MODEM STATUS, "LOC B" MODEM STATUS, "REM A" MODEM STATUS, and "REM B" MODEM STATUS explain how the DATA SET READY signal is used in the TLCF subsystem.

"LOC A" MODEM STATUS

On the LINK TEST/STATUS UNIT there is an indicator lamp labeled "LOC A". This lamp indicates that local line modem A is powered on. The TLCF line modem DATA SET READY signal activates the LOC A lamp.

"LOC B" MODEM STATUS

The definition of this status line is similar to "LOC A" MODEM STATUS.

"REM A" MODEM STATUS

The definition of this status line is similar to "LOC A" MODEM STATUS. Note, however, that DATA SET READY is remoted from the remote line modem "A" to the LINK TEST/STATUS UNIT via VFCTs.

"REM B" MODEM STATUS

The definition of this status line is similar to "LOC A" MODEM STATUS. Note, however, that DATA SET READY is remoted from the remote line modem "B" to the local LINK TEST/STATUS UNIT via VFCTs.

"OM-43A XMT A" MODEM STATUS

This line is derived from the XMT RDY signal within the WSC-3 baseband interface unit (BIU) and indicates that the rf terminal is transmitting. This status line is remoted to the LINK TEST/STATUS UNIT (LT/SU) via VFCTs. The LT/SU OM-43A XMT A lamp will light when the uhf radio is transmitting.

"OM-43A XMT B" MODEM STATUS

This line is similar to "OM-43A XMT A" MODEM STATUS.

OM-43 LOOP-BACK TEST

This command line is activated from the LINK TEST/STATUS UNIT (LT/SU). When the LT/SU OM-43A LOOP-BACK TEST switch is switched to "A" or "B", the OM-43A will switch to an internal loop-back condition when DATA KEYLINE is activated. LOOP-BACK TEST is a logic AND of DATA KEYLINE and LOOP BACK "A" or "B". When thus commanded, the OM-43A will loop its 70-MHz transmit-out signal to its 70-MHz receive-in signal.

BIBLIOGRAPHY

1. Naval Electronic Systems Command, AN/WSC-5(V) Tactical Satellite Communication System Operation and Maintenance Instructions, NAVELEX Document 0967-43-4010.

2. Naval Electronic Systems Command, Technical Manual, Operation Instructions/ Maintenance Instructions, Intelligence Interconnecting Group ON-143(V)/UFQ, NAVELEX Document 0967LP614710.

3. Naval Electronics Laboratory Center, Link Test/Status Unit, by J Wangler and H Chin, NELC TN 3217, 14 September 1976.

4. Naval Electronic Systems Command, Technical Manual for Data Processing Set AN/UYK-20(V), NAVELEX Document 0967-LP-598-1030.

5. Naval Electronics Laboratory Center, Technical Description of SSIXS Remoting Problems Between COMSUBPAC OPCONCEN and NAVCOMMSTA HONO, NELC Ser 3200-M-103, dated 24 February 1976.